

REMARKS/ARGUMENTS

The applicants thank the Examiner for his Office Action dated November 22, 2004. Claims 2, 4, 5, and 16 have been amended. Claims 1 and 6 have been cancelled (in addition to previously cancelled claims 7 & 9). Claims 10-15 were previously withdrawn (without prejudice) from consideration. Claims 19-22 were previously added. Thus, Claims 2-5, 8, and 16-22 are currently pending in the application. No new matter has been introduced. Reconsideration and allowance are hereby requested.

ART RELATED REJECTIONS

1. Rejections based on *ZHONG*:

Rejections Under 35 U.S.C. § 102

Claims 1-6, 8, and 16-18 have been rejected under 35 U. S. C. §102(e) as being unpatentable over *Zhong, et al* (US Pat. Appl. Publ. No. 2003/0179549A1)(hereinafter *Zhong*).

Claims 1-6 and 8:

As to Claim 1 this claim has been cancelled making this grounds for rejection.

As to Claims 2, 3, 4, 5, and 8, the applicants point out that the claimed apparatus a "substrate including at least one electrical ground plane". This limitation is missing from *Zhong*. The Action characterizes 720 of *Zhong* a ground plane. A close reading of *Zhong* reveals that 720 is "an exposed contact pad 720" or alternatively as "a metal pad, ring, trace, or other land type contact". In *Zhong*, 720 is merely as a contact point for an electrical connection. As is known to those having ordinary skill in the art a ground plane is a large planar metallic construction which covers a large portion of a substrate or die surface. It is not a small contact pad or thin ring structure. Consequently, *Zhong* fails to teach a ground plane and is therefore missing an element of the claimed invention.

Additionally, the claimed invention includes a heatspreader in thermal communication with the "outermost row of thermal solder balls positioned near the perimeter of the package". There is no teaching or suggestion that the heat spreader of *Zhong* is connected with an outermost row of thermal solder balls at the perimeter of the package. Moreover, *Zhong* does not teach or suggest that such vias should be connected to the outermost row of thermal solder balls at the periphery of the substrate as claimed in the present invention.

On the surface this seems to be a superficial distinction. However, in operation, the positioning of the thermal balls at the outer edge of the package has significant performance advantages. For one it more effectively exposes the balls to the ambient cooling temperature at the edge of the package. Whereas, if the balls are closer to the center, the heat is trapped under the package and does not help cooling. This fact is particularly relevant because the *Zhong* patent does discuss improved cooling performance in great detail. In fact, it mentions the close proximity of the heatspreader to the die and the increased size of the heatspreader as causes of increased thermal performance. Significantly, *Zhong* does not mention the use of an outermost row of solder balls as a cause of improved thermal performance nor does *Zhong* mention thermal cooling paths from the heatspreader into the outermost row of thermal balls. *Zhong* simply misses the point and expresses no appreciation of the unique advantages wrought by the claimed invention. Thus, not only does *Zhong* not teach this claim limitation, *Zhong* also does not suggest this claim limitation.

Accordingly, *Zhong* has failed to teach all the claim limitations, as required to sustain an anticipation rejection under §102. Therefore, *Zhong* has failed to establish an effective rejection as to Claims 2-5 and 8. Additionally, the dependent claims are allowable for other reasons. For example, Claims 4 and 5 are allowable because the heat spreader mounting pegs are used to dissipate heat into the ground plane and solder balls. Accordingly, applicants respectfully suggest that this grounds for rejection should be withdrawn.

Claims 16-18:

As to Claim 16, the same arguments raised above apply. For example, the cited references do not teach or suggest “a substrate including at least one electrical ground plane” or “a set of thermal solder balls electrically connected with a ground plane and positioned near the perimeter of the package”. Additionally, the cited art does not teach a “heat spreader mounted on the package with conductive mounting pegs”. No mounting pegs are depicted in *Zhong*, rather the only features described in *Zhong* are metal filled conducting vias 720. Additionally, the vias are not part of the heat spreader as in the claimed invention. Instead the vias comprise a delicate portion of the substrate whose only function is to carry current. Commonly, vias are much thinner and smaller than the robust structures comprising mounting pegs. Vias 720 typically have diameters of on the order of microns. This is necessary and desirable to increase interconnect density. Whereas a mounting peg is a structural feature designed to strongly support the heat spreader when it is placed on the substrate. In fact, the heat spreader (and its

mounting pegs) provide protection for the delicate underlying via structures during subsequent assemble and processing. Also, the larger size of a mounting peg makes it easy to position on a substrate. This would not be the case using a micron scale via. The mere attempt at aligning a via sized projection with a via sized hole (on the substrate or elsewhere) to attempt alignment and placement of a heat spreader would be disregarded as foolish by one of ordinary skill. Quite simply, there are no mounting pegs depicted or otherwise described anywhere in *Zhong*. Accordingly, *Zhong* cannot be said to teach or suggest a heat spreader having conductive pegs in thermal communication with the thermal solder balls.

Accordingly, *Zhong* has fails to teach all the claim limitations of **Claim 16**. Accordingly, *Zhong* is insufficient to sustain an anticipation rejection under §102 as to **Claim 16**. Accordingly, applicants respectfully request withdrawal of this ground for rejection. Moreover, for at least these reasons, the cited art has failed to teach all the claim limitations of rejected dependent claims 17 and 18. Therefore, *Zhong* has failed to sustain an anticipation rejection under §102 as to these claims. Other distinctions between these dependent claims and the cited art can be made. Accordingly, applicants respectfully suggest that this grounds for rejection be withdrawn as to **Claims 16-18**.

Therefore for the reasons expressed above, the applicants respectfully request the withdrawal of the rejections of **Claims 1-6, 8, and 16-18**.

2. Rejections based on HUANG:

Rejections Under 35 U.S.C. § 102

Claims 1-3, 6, and 8 have been rejected under 35 U. S. C. §102(e) as being unpatentable over *Huang, et al* (USPN 6,703,698)(hereinafter *Huang*). However, the asserted argument and case law appear to be grounded in 35 U. S. C. §103. This is especially relevant in view of the comments made in the Office Action at the bottom two lines of page 6 where the invention is described as obvious.

Claim 1 has been cancelled and therefore this grounds is made moot as to **Claim 1**.

As to a 102 rejection of **Claim 2**, *Huang* fails to teach "a substrate including at least one electrical ground plane". The ground plane 201b of *Huang* is part of the die (e.g., 210). Thus, *Huang* makes use of a completely different substrate structure. This is a non-trivial exercise because by using a substrate mounted ground plane the claimed invention attains far superior electromagnetic interference (EMI) performance over any such constructed as suggest with

respect to *Huang*. Consequently, *Huang* fails to teach a ground plane as part of the substrate as required to sustain an anticipation rejection under §102.

Additionally, the cited law has been misapplied to the case at hand. The prior art positioning of the ground (e.g., 212b) on the chip serves to increase heat near the chip rather making the problem worse. In contrast, the claimed invention by having a substrate mounted ground plane directs heat further away from the chip by placing a ground plane (or two) on the substrate farther away from the heat source (the chip).

Moreover, for at least these reasons, the cited art has failed to teach all the claim limitations of rejected **dependent Claims 3, 6, and 8**. Other distinctions between these dependent claims and the cited art can be made, but are not deemed necessary at this time due to the sufficiency of the arguments made hereinabove. Accordingly, applicants respectfully request the withdrawal of this ground of rejection as to Claims 1-3, 6, and 8.

Rejections Under 35 U.S.C. § 103

Claims 4, 5, and 16-18 have been rejected under 35 U. S. C. §102(a) as being unpatentable over *Huang, et al* (USPN 6,703,698)(hereinafter *Huang*).

As to **Claim 4** (and **claims 1-3**), *Huang* is cited as teaching conductive mounting pegs 201c. The *Huang* specification clearly points out (for example at col. 5: lns. 43-46) that the “pegs” are actually “I/O vias”. Thus, *Huang* does not teach a heat spreader having pegs. *Huang* teaches a standard technology, a substrate with vias. The vias comprise delicate portions of the substrate whose only function is to carry current. As explained above, vias are much thinner and smaller than the robust structures comprising mounting pegs. Vias 201b typically have diameters of on the order of microns. This is necessary and desirable to increase interconnect density. Whereas a mounting peg is a structural feature designed to strongly support the heat spreader when it is placed on the substrate. Also, the larger size of a mounting peg makes it easier to position and align on a substrate. This would not be the case using a micron scale via. This is known to those having ordinary skill in the art. Quite simply, there are no mounting pegs depicted or otherwise described anywhere in *Huang*. Accordingly, *Huang* cannot be said to teach or suggest a heat spreader having conductive pegs in thermal communication with the thermal solder balls

The pegs of the present heat spreader are intended to be positioned in mounting holes that pass entirely through a substrate. No such pegs are present in *Huang*. Additionally, *Huang* specifically fails to teach "a substrate including at least one electrical ground plane". The ground plane 201b of *Huang* is part of the die (e.g., 210). Thus, *Huang* makes use of a completely different substrate structure. Using a substrate mounted ground plane is not an obvious engineering choice due to the substantially improved EMI properties of the resultant shielding structure. Consequently, *Huang* fails to teach or suggest the claim limitations of: 1) a ground plane as part of the substrate and 2) mounting pegs on the substrate (such pegs are typically fitted into substrate openings to align and properly position the heat spreader) as required to establish a *prima facie* case of obviousness as required under §103.

Accordingly, *Huang* has failed to teach all the claim limitations of Claim 4. Accordingly, *Huang* has failed to establish a *prima facie* case of obviousness as to Claim 4. Therefore, applicants respectfully suggest that this ground for rejection be withdrawn.

Moreover, since the same limitations are present in Claims 5 and 16-18, for at least the above reasons, cited art has failed to teach all the claim limitations of these claims. Other distinctions between these claims and the cited art can be made. However, the applicants respectfully suggest the arguments made with respect to the base claims are sufficient and accordingly ask that this grounds for rejection be withdrawn as to Claims 4, 5, and 16-18.

New Claims 19-22:

Claims 19-22 were previously added to more clearly capture certain patentable subject matter. No discussion of these claims was made in the Examiners Office Action dated November 22, 2004.

In Claim 19 the mounting pegs are more clearly identified as being "conductive mounting pegs that pass through the substrate". Support for this language is found throughout the specification. For example, see Fig. 2 "212" or Fig. 3 "312" and the associated supporting language in the specification. Also, the pegs are clearly identified as contacting "leads formed on the back surface of the substrate" wherein the leads extend "outward from the middle of the substrate to the set of thermal solder balls positioned near the perimeter of the package" thereby enabling a portion of the heat generated by the die to be dissipated from the die through the heat spreader into the set of thermal solder balls. Again reference is made, for example, to Fig. 4(b) "405" and the supporting specification. The distinctions between a via and mounting peg are expounded up above and therefore will not be reiterated here. Additionally, the arguments made above with respect to, for example, Claim 16 are similarly applicable here. Moreover, there is no

teaching in the cited art of "conductive mounting pegs that pass through the substrate" or "leads formed on the back surface of the substrate" such that the leads extend "outward from the middle of the substrate to the set of thermal solder balls positioned near the perimeter of the package". Absent teachings of these limitations, it is respectfully submitted that the added claims 19-22 are allowable over the cited art.

Conclusion:

In view of the foregoing amendments and remarks, it is respectfully submitted that the claimed invention as presently presented is patentable over the art of record and that this case is now in condition for allowance.

Should the Examiner, for any reason, wish to contact the undersigned, he is cordially invited to do so at his convenience. Moreover, if the Examiner has any continuing concerns regarding this case, he is invited to contact the undersigned at (650) 961-8300.

Respectfully submitted,

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